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CANTOR LECTURES.

"ON SOME OF THE MOST IMPORTANT CHEMICAL DISCOVERIES MADE WITHIN THE LAST TWO YEARS." BY DR. F. CRACE CALVERT, F.R.S., F.C.S.

LECTURE III.*

DELIVERED ON TUESDAY, THE 18TH OF APRIL, 1865.

On the Discoveries in Physiological Chemistry.

I intend in this lecture only to give you a general outline of some of the main facts connected with the phenomena of digestion and respiration, introducing as I proceed some of the most important chemical facts connected with that branch of science discovered or observed within the last two years. To enable you to appreciate more fully the importance of those discoveries, I shall divide my lecture under two principal heads:—First—the studying with you those facts which have a special reference to digestion and respiration; and secondly—those which have a more immediate connection with the human system in their direct action as therapeutic agents.

DIGESTION.—Man requires several varieties of food to maintain the health and strength of the body. One of the most important of these is atmospheric air, which is chiefly used to maintain the heat of the body so essential to vitality, by oxidising the various substances taken as food, or by oxidising the tissues which have been destroyed in the body by the wear and tear of life, and which, having fulfilled their functions, require to be removed, that new tissues may replace those which have disappeared.

The next class of food which man requires are fluids, which are chiefly represented by water, either pure or mixed with other substances, and which fulfil in the body two principal functions—that of carrying into the stomach and the intestines various nutritious elements which have been taken as food, and conveying them into the blood by endosmosis, or the force called by Mr. Thomas Graham, the master of the Mint, "diffusion."

The second purpose which liquids fulfil in the human system, is to remove from the blood those various substances which have been acted upon by the atmosphere, as above explained, or others which have been produced by the action of vitality, and which require also to be removed from the system to enable it to be in a normal state.

* Lecture II. will appear in a future number.

Again,—Man requires various mineral matters, but these must be of a peculiar nature, so as to render them fit to fulfil in the organism the different functions to which they are adapted. Thus we find that man requires soda, potash, lime, manganese, iron, chlorine, sulphuric acid, phosphoric acid, and other mineral elements of minor importance. No doubt that for man, as for plants, the nature and the relative proportions of the mineral matters entering into the food which he takes are most essential; for if in that food a sufficient amount of salts of soda were not present, one of the essential elements of blood would be wanting. If phosphate of lime is not supplied in due proportions, the frame-work of his body will suffer. The same may be said of the importance of carbonate of lime in the water which he takes as a beverage; and, therefore, it is yet a question to be solved by experience, whether the extremely pure water which is now introduced into several of our principal cities, such as Manchester, Glasgow, &c., so agreeable to the general feelings of the public, under the impression that it is pure water, and which confers such benefits on manufactures in general, will not, in course of time, prove detrimental to the health of the inhabitants, owing to its extreme purity, not containing carbonate of lime, which is so essential to the formation of bone in man and animals.

The fourth class of food that man requires may be called heat-producing or respiratory food. This food is chiefly assimilated and employed by him to maintain the heat of the body, through the action of the oxygen of the atmosphere, and which, being dissolved by the blood, circulates with it, and burns or oxidizes its carbon, converting it into carbonic acid. This class of food is mainly represented by starches, gums, sugars, oils, fatty matters, and several other substances, such as pectic acid, pectose, &c.

The fifth class of food is flesh or blood-forming food, which is employed in the system to replace the various animal tissues which have fulfilled their functions, and which are modified and altered by the action of the oxygen of the atmosphere as above explained, or are destroyed by the tear and wear of life, and which leave the system principally in some modified state, by means of the fluid taken as a beverage. This class of food is represented by fibrine, albumen, caseine, and other similar nitrogenated substances, which we find compose in a great measure flesh, blood, milk, and other similar foods.

As it is impossible for me, in the course of one lecture, to give you a correct idea of the chemical phenomena involved in the digestion of the five various classes of food to which I have referred, I must confine my observations to the digestion of the two last classes of food, namely,

the heat-producing foods, and the flesh or blood-forming ones. The blending of chemistry with animal physiology has thrown much light on the phenomena of digestion; in fact, until chemistry had investigated many of the actions which take place in the digestion of foods, much obscurity existed, and many empirical views were promulgated on these important and essential functions of life. But since chemistry has penetrated into this branch of science, it has brought to light many facts which could not be understood or satisfactorily explained until the chemical facts connected with digestion had been well studied, and much light thrown on the complicated phenomena.

Although I do not agree in the opinion entertained by some persons that the phenomena of digestion are purely due to chemical actions, on the other hand I am of opinion that they cannot be regarded as entirely due to the force called vitality. My opinion is that the phenomena of digestion are due to the simultaneous or successive actions of vital and chemical forces. Thus, for example, the secretion of the various fluids necessary for digestion is due to vitality, and the influence of the fluids secreted on the substances taken as foods is due to chemical action, or, in many instances, to actions not yet well understood, but which still come under the head of chemistry, namely, purely chemical fermentation. I understand by this term the peculiar conversion or unfolding which certain substances undergo by the presence or contact of minute quantities of other substances, such, for example, as the conversion of starch into dextrine and sugar under the action of the peculiar ferment called diastase, or the unfolding of amygdaline into hyduret of benzoil, prussic acid, &c., under the influence of a ferment called emulsine. But we must bear in mind that this class of fermentations are perfectly distinct from those which I described to you in the last lecture of my course delivered in 1864, which fermentations referred to those which are determined or produced in consequence of the development in the fluids of certain microscopic vegetables or animals which, by their peculiar mode of growth or life determined the changes which are observed in many vegetable and animal fluids when in a state of fermentation or putrefaction.

With these explanations I shall now proceed to state that there are five principal fluids which are essential to digestion, and which are secreted by various organs which participate in the actions which take place during digestion, and these are:—1, *Saliva*, which is secreted by certain glands in the mouth; 2, *Gastric juice*, secreted by the membranes of the stomach; 3, *Pancreatic juice*, secreted by a gland situated just beyond the outlet of the stomach; 4, *Bile*, secreted by the liver; 5, a *Gaseous medium*, called atmospheric air.

Let us now examine how and to what degree each of these fluids acts upon the two special classes, and which I have stated are blood and heat-forming foods.

Animal Food.—When meat, for example, is taken as a means of subsistence, although it is divided into small pieces by mastication, and gradually brought into the form of a ball, so as to pass with facility from the mouth into the stomach, still it undergoes no chemical change by the mixing or imbibition of the saliva. But when it arrives in the stomach, it meets here a very acrid fluid called gastric juice, the acidity of which is due, not to hydrochloric or acetic acids, as was formerly stated, and which are now attributed to indigestion, but to the presence of phosphate and lactate of lime, together with a little free lactic acid, which acid elements are essential not only to the action of the ferment called pepsine, but also facilitate its solution. This pepsine acts in a most remarkable manner, for a minute trace of it appears to have the power to liquefy, if I may so express myself, the solid substance called fibrine, and to alter its conditions. In fact, all the solid animal elements of food become fluid under the action of the gastric juice, and are transformed into the fluid mass which has received the name of albuminose or pectose. The animal matter so transformed is susceptible of being absorbed either by endosmosis or diffusion by the coats of the stomach, but the greatest part of it passes on into the small intestines, where it meets the bile, and where the acidity of the fluid is neutralized and it becomes alkaline owing to the alkaline state of the bile. This transformation of the acidity of the gastric juice into an alkaline character, is essentially owing to the fact that during its passage through the small intestines it is in a fit state to be absorbed by the mucus which coats those vessels of the human organism, and to come in contact with the blood, which is always in an alkaline condition. Further, we know that organic matter in an alkaline condition enters more rapidly into decay and decomposition, so that it is thus in a fit state to be rejected by the body. Therefore, in the digestion of animal matters, we may consider there is only one active fluid which participates in it, namely, gastric juice, pancreatic juice and the bile only acting as alkaline fluids to bring it into a proper state to be absorbed by the mucus, and to be carried by the blood into the torrent of circulation.

Here I must pause in my description of digestion to make you acquainted with some of the recent discoveries which tend to prove that gastric juice does not simply liquefy fibrine and caseine, but that it acts also on albumen in such a way as to modify its molecular condition, and thereby its chemical properties. If the albumen of an egg be injected into the jugular vein it passes unaltered to the blood, for it is found in the secretions of the kidneys; but if the same be injected into one of the ramifications of the portal vein, then it has to pass through the liver, and therefore through the torrent of the circulation of the blood, and it is then so modified that it becomes assimilated and cannot be traced in the secretions of the kidneys. It follows that albumen of the egg must undergo a molecular change to render it fit to become assimilated, and we may assume, therefore, that it experiences the same change in the stomach under the influence of the ferment, called pepsine. But I cannot conclude this part of my subject without calling your attention to some interesting researches lately published by Mr. Smee. Until the publication of those researches, although scientific men had assumed that there must be an identity between albumen, fibrine, and caseine, which are the chief elements representing animal food, still they had not been able to demonstrate their convertibility one into the other. Now Mr. Smee has accomplished that fact; or, in other words, has reversed the theory previously entertained as to what takes place during digestion; for he has established that fibrine, or the clot of blood; caseine, or the curd of milk; and albumen, the serum of blood, are convertible into one fluid, which he has called albumenose, or pectose. Mr. Smee has succeeded, I say, in reversing the problem, and has shown that albumen may be converted into fibrine, and probable caseine. To effect this interesting change he proceeds as follows:—He passes a current of pure oxygen gas through a solution of albumen of blood or egg, slightly acidulated with acetic acid, and at a temperature of blood heat, or of 98° to 100°, and after several hours a mass of fibrine appears, the production of which is facilitated by bringing into play the action of an electrical current. If instead of an acid solution of albumen, Mr. Smee employed a weak alkaline solution of the same substance, it became transformed into a peculiar substance which I described to you in my last year's lecture, under the name of chondine. But I would strongly recommend to all lovers of animal physiology to read the interesting papers which have been published by that gentleman in the Proceedings of the Royal Society, 1864 and 1865.

Fatty Matters.—Allow me now to have the pleasure of calling your attention to the modifications which fatty matters have to undergo when taken into the human system, before they are prepared for assimilation. Most physiologists maintain, at the present day, that these substances undergo a change during their retention in the

mouth or their passage into the stomach, but Dr. Marcet is of opinion that fatty matters undergo a certain modification during their passage from the mouth to the entrance of the small intestines. At all events, there can be no doubt, from the researches of some of the most eminent physiologists, that fatty matters undergo a most important change when they arrive in contact with the fluids secreted by the gland called the pancreas, which transforms them into an emulsion, but does not saponify them. The matters so emulsioned are then further acted upon by the bile, and finally are absorbed by the lacteal vessels, and carried into the circulation of the blood. It is the absorption of fatty matters by the lacteal vessels which deceived the physiologists of an earlier date, and led them to believe that that white substance was the absorption of the nutrient parts of food, to which they gave the name of chyle, and which, according to them, gradually became transformed into the element of blood. Fatty matters so absorbed and carried into the torrent of the circulation of the blood fulfil two purposes—either they are consumed through the oxidation of the oxygen contained in the air inspired, and thus they help to maintain the heat of the human body, or they are stored up with the view of supplying the elements necessary to the maintainance of the heat of the body, when, through disease, the body has ceased to take its ordinary external nourishment. In fact, we may consider these fatty matters to be to the body what the coal-fields of England are to its manufactures.

Another division of the heat-forming or respiratory foods is that to which I have already referred, and which includes starch, gum, and sugar, and the transformations which these peculiar substances, and especially starch, undergo in order to become assimilated. Allow me to claim your undivided attention to the facts which I am now going to bring forward. When bread, potatoes, or any amylaceous substance, arrives in the mouth, it gradually becomes mixed and saturated with saliva—1st, the saliva of mastication, which is secreted by the paroted glands, and serves only to coat the mass of food called the ball, and so facilitate its passage into the stomach; 2nd, the saliva which is secreted by the sub-maxillary glands, a thin, watery fluid, which acts chemically on the food, converting the insoluble starch into soluble elements called dextrine and sugar. The amilaceous substance thus acted on passes into the stomach without further action, but when it arrives in contact with the fluid secreted by the pancreatic glands, there it undergoes a complete change; for the pancreatic fluid, called by the Germans the intestinal saliva, completes the conversion into dextrine and sugar of such portions of the starch as have not been acted on by the saliva of the mouth. For both these fluids are alkaline, I mean the pancreatic fluid and the saliva from the sub-maxillary glands; for that secreted by the paroted glands is acid, and this explains why the saliva is always acid in the morning or before man has taken food. I say that these fluids are alkaline, and they contain a ferment called diastase—a ferment identical with that which exists in malt, and which converts in the brewer's vat his mash into a saccharine fluid, which ultimately becomes beer. The starch so converted into dextrine and sugar through the action of the diastase of the saliva and of pancreatic fluid is absorbed by the mucus of the small intestines, and conveyed by the small veins which line those organs into the *veina porta*, and thence into the liver. This important organ fulfils several functions. First, it secretes bile, an alkaline fluid, which, as we have seen, acts as a neutraliser of the acid fluids arriving from the stomach, converting them into an alkaline condition fit for decay. Secondly, it is an eliminating organ, for the bile appears to contain some of the elements which require to be removed from the blood, and which have been produced through the wear and tear of life. Further, it contains some of the elements of the colouring matter of blood, for the colour of bile and that of the blood appear to have a resemblance. But the most important substance which the liver contains is a peculiar ferment, discovered by M. Claude de Bernard, which has the power to transform the insoluble substance which he calls glycogen into a soluble one, namely sugar. Thus it would appear, from the researches of that eminent physiologist, that the amylaceous substances absorbed as food, and acted on as above explained, arrive by the *veina porta* in the liver, and there are stored until required by man to maintain the heat of his body and the phenomena of life. He has observed—and the results at which he has arrived have been confirmed by C. G. Lehmann, another eminent physiologist—that there is comparatively only a small amount of sugar in the blood when it passes into the liver by the *veina porta*, whilst the same blood, when it leaves the liver by the hepatic veins, contains a comparatively large quantity. Thus Lehmann has found that the quantity of sugar in the *veina porta* blood amounts to from 0·21 to 0·30, whilst in the hepatic veins the quantity is from 0·87 to 0·98; and that the hepatic blood so charged with sugar first passes into the right ventricle of the heart, then into the lungs, thence into the left ventricle of the heart, whence it is driven, by the contraction of that organ, into the torrent of circulation. I say "the torrent of circulation," and as perhaps few persons are aware with what rapidity blood circulates through the human system, it may be interesting to state that every time the heart contracts, about three ounces of blood are driven out, and as there are about sixty pulsations of the heart per minute, the consequence is, that the 33 lbs. of blood which is contained in the body of an adult passes through the whole of his system—lungs, heart, kidneys, liver, and even through the most minute capillary vessels—in the space of three minutes. The knowledge of this fact will explain how small quantities of matter coming in contact with the blood may produce a most injurious action on the system—how, for example, the smallest quantity of strychnine, curorine, prussic acid, and other such substances, can act upon the blood, modify its nature, and produce death in a few minutes.

The curious substance called glycogen by Claude de Bernard was extracted by him from liver, by the following process:—The liver of an animal recently killed was cut into thin slices and thrown into a small quantity of boiling water. The whole was allowed to boil for an hour, and was then submitted to pressure. A small quantity of fluid was obtained, which, when treated by alcohol, yielded a white flocculent precipitate, and this, when re-dissolved in water, and re-precipitated by alcohol, was then found to yield with iodine and other re-agents the characteristic properties of amylaceous substances. Although glycogen exists in larger quantities in the liver when man or an animal takes a large quantity of amylaceous substances as a part of food, still this substance is found in the livers of carnivorous animals, showing that under the force called vitality animal matters are susceptible of undergoing the chemical change which converts them into a substance similar to starch. But this glycogen gradually disappears from the blood as it passes from the hepatic veins into the heart, and lastly through the torrent of circulation, for the oxygen of the atmosphere rushes into the lungs by inspiration, gets into contact with the blood in the numberless cells composing them, and by its action upon the glycogen helps to convert it into water and carbonic acid gas, which are thrown out by expiration. Now, although this conversion of the glycogen proceeds during the whole of the circulation of the blood, still there can be no doubt that the greatest portion of it is converted into gaseous elements when it comes in contact with the oxygen of the air in the cellular tissues of the lungs, for much less glycogen is found in arterial blood than in that of the hepatic veins.

To smooth the pathway of the reader to the perfect understanding of the above statement, it is perhaps necessary to add that when the blood leaves the liver it travels

through the hepatic veins into the right ventricle of the heart; that by the contraction of that organ the venous blood is thrust into the lungs, where it comes in contact with the oxygen of the atmosphere, and is converted from the dark purple colour which characterises venous blood into a brilliant red coloured fluid, called arterial blood. Having undergone that change, it runs thence into the left ventricle of the heart, and having filled it, that organ contracts itself, and drives the blood with great force through the whole of the arterial system, and during its passage through the capillary vessels it gets converted gradually into venous blood, which reaches through the various veins the *veina porta*, and this conveys it to the liver. Thus we can perceive how the blood constantly flows in a circular motion through the whole of the human system. At all events, before proceeding with the few remarks I have to offer on respiration, and calling attention to recent discoveries which have been made in connection herewith, allow me to state that Lehmann has published the following data respecting the action of the liver on the various elements contained in the blood. He has found that there is much more fibrine in the *veina porta* than in the hepatic veins; that albumen is more abundant in the portal than in the hepatic veins; that fatty matters are in larger quantities in the portal than in the hepatic; that globullin, or the substance which represents the globules of blood, is in less quantity in the portal than in the hepatic; whilst the colouring matter, called hematozine, is in larger quantities in the portal than in the hepatic. This, according to Lehmann, explains why we find colouring matters in bile, which may be considered as modifications of the one existing in blood, and which are found only in that fluid.

Although it is impossible in a lecture like this to attempt to give a correct idea of all the phenomena connected with respiration, and all the data which bear upon that important function of life, I may be permitted to give a few data, which will enable you, I hope, to have a general idea of the present theory of respiration. Man inspires about thirty times a minute, and at each inspiration there rushes into his lungs about a pint and a-half of air, which penetrates into the myriads of cells composing the lungs, and comes in contact there with the blood, as above stated, which it converts from venous into arterial. At the same time a certain quantity of air, or oxygen, is dissolved, which not only effects the above conversion, but displaces from the venous blood a certain quantity of carbonic acid, which it contains. Thus it is found by experience that one hundred parts of air that man inspires, contains, in round numbers, 21 parts of oxygen; whilst the gases he expires are represented by 16 parts of oxygen, four parts of carbonic acid, and one part of oxygen which has been transformed into water, thus making up again the 21 parts of gaseous matter in the 100 which he inspired. But the production of this carbonic acid is chiefly caused by the action of the oxygen dissolved in the arterial blood during its passage and contact with the animal tissues and the glycogen existing in the capillary vessels; for it is there that we observe the change of blood from arterial to venous, the conversion from venous into arterial being, as above stated, in the lungs.

Several theories have been promulgated by chemists and physiologists as to how the oxygen acts to convert venous into arterial blood. Liebig assumed that the blood dissolved oxygen as water dissolves that gas and others; and he explains the greater solubility of oxygen in the blood than in water, by asserting, and that on experiment, that phosphate of soda, which exists in blood, facilitates the solution of oxygen in that fluid. Dumas states that it is the iron which exists as one of the elements of the colouring matter of blood, called, as above stated, hematosine, which fixes the oxygen in the arterial blood, and yields it again to various organic matters, either those originating from glycogen or those resulting from the wear and tear of life, and which may be considered as refuse matters which require to be removed from the system. The iron thus becomes deprived of its oxygen, and is ready to reabsorb a fresh quantity when it comes again in contact with the oxygen of the atmosphere in the lungs.

These theories do not appear, so far as I am aware, to have received the general sanction of physiologists; and I therefore deem it to be my duty to call your attention to some interesting optical researches, due to that eminent *savant*, Professor Stokes, of Cambridge. That gentleman has observed that when a small quantity of blood is mixed with water, and the whole poured into a small tube, and this, in its turn, placed in such a position as to allow a ray of light to pass through the blood solution, and that then the ray of light is made to pass through a prism, he finds that the spectrum so produced has undergone certain modifications, which consist in the fact that certain tints or colours of the spectrum have disappeared; and he, moreover, observes that these "bands of absorption," as he calls them, are characteristic, for they differ according as the blood placed with the water in the tube is arterial or venous, and so delicate is this mode of investigation that he can discern the slightest modifications which blood undergoes. In fact, I may state *en passant* that he has applied this mode of investigation to distinguish vegetable and animal matters, which, though having a great similitude, become distinguishable by the simple mode of applying optics to their investigation.

Coming back to blood, I may state that the researches of Professor Stokes on the action of oxidising agents on blood, have thrown much light on the phenomena connected with the conversion of venous into arterial blood. He has remarked that if arterial blood is shaken with an alkaline solution of sulphate of protoxide of iron, or protochloride of tin, it assumes the dark colour of venous blood, and that if he then agitates the same dark purple blood with air, it absorbs the oxygen, becomes oxidised, and, therefore, is converted into red arterial blood.

These facts, joined to many more which can be found in the proceedings of the Royal Society, for 1864, have led Professor Stokes to the conclusion that the colouring matter of blood is the real carrier of oxygen; that it absorbs oxygen and becomes scarlet; and that it yields its oxygen to organic substances during its circulation through the system, and becomes purple or venous blood. He has given to the colouring matter of blood the name of *cruorine*, and calls it purple or scarlet cruorine either as it exists in the veins or arteries.

I think it is useless to repeat here many facts connected with this subject, and which I brought to your notice in my last year's lectures.

Urine.—Having also dwelt in my last course at some length on the principal elements contained in this important secretion, I deem it my duty merely to call your attention to one or two facts of some immediate importance which have been published since then. One of these is due to Dr. Marcet, who has found in that secretion a substance which, until his investigations, had been unnoticed by chemists. I mean an amorphous or non-crystallizable acid, which he calls colloidic acid, from the circumstance that it cannot pass or diffuse itself through animal membranes. I may here mention that substances in general, according to the theory of Mr. Thomas Graham, the master of the Mint, may be divided into two classes, namely—those which crystallise, and which he calls crystalloids, and those which do not diffuse, and which he calls colloide, from the French word *colle*, or glue. M. E. Morin has also published some elaborate researches on the relative proportions of oxygen and carbonic acid in urine, and the following table will show you the influence which exercise has upon the combustion of organic matter through the oxygen conveyed in the blood by the cruorine of Professor Stokes, converting the organic matter into carbonic acid, for this gas is found, as you will see, more abundantly in the urine of man when in a state of activity than when in a state of repose:—

Gases in the Secretion of the Kidneys.

Quantities of Gases in 100 Parts of Urine.	Composition of the Gases.	Activity.	Repose.
From 2·62 to 3·61	Carbonic Acid ...	73·56	62·93
	Oxygen	1·65	1·89
	Nitrogen	24·79	35·18
		100·00	100·00

I wish now to invite your consideration for a few minutes to some interesting facts which have lately been published by Dr. H. Bence Jones, on the extraordinarily rapid absorption of certain substances into the animal system. He has observed that substances, such as lithium and rubidium will be found to have passed into the whole of the human system three or four hours after they have been administered, either as medicines or as a matter of experiment. In fact, he has found that the absorption is so complete that he has been able to detect their presence in the non-vascular textures of the body; and what enhances the interest of his researches is, that he employed, as a means of analysis, for the detection of these substances, the property which they have of communicating colour to flame, and therefore applied to their detection the spectroscope of Bunsen and Kirchoff.

Whilst on the subject of the rapidity of the absorption of matter by the body, I may state that a French physiologist has observed that certain saline matters, such as iodide of potassium, nitrate of potash, or acetate of morphia, will pass in a few seconds through the whole of the system. Thus he was able to detect the presence of iodide of potassium in the urine three minutes after it had been taken by the mouth. But certainly one of the most curious instances published of late respecting the absorption of organic matters in the system is that related by Dr. Letheby, and which tends to prove the correctness of statements which have been published in former times, that certain chemists or persons had a secret of producing poisons, the action of which only became manifest a long period after they had been administered. Thus, Dr. Letheby states, in a paper which you will find in the "Proceedings of the Royal Society," and which contains some of the facts which he gave in evidence at a coroner's inquest in London, that the death of a person ensued twelve months after he had taken the substance which cau ed death. A man engaged in a large chemical works in London had inspired, during his labours, a comparatively small quantity of a substance called nitro-benzine (now sold under the name of oil of bitter almonds, and used in large quantities for perfumery, and also for giving taste to various culinary preparations), and that this substance had gradually become converted into aniline (a substance now extensively used to produce colours, and also procurable from coal tar), and had been the cause of the death of the man.

I would invite all lovers of animal physiology to read with attention the researches of M. Claude de Bernard on the physiological action of curorine, or the active principle of the curore, or the poisonous mixture used by the Indians at Madagascar, and on the banks of the river Oronoco. These researches will be found in several articles published by him in the *Revue des Deux Mondes*, 1864; and, to excite your interest in reading the articles, I may state on his authority that the death which ensues by the injection into the blood of a trace of this poison may be considered as the most curious and distressing that can be conceived, and, he further states, that the physiological phenomena which are witnessed during the process of death may lead to the most beneficial application of the substance as a therapeutic agent.

Although time is pressing, I cannot part from you this evening without calling your attention to the fact that every day we are realising the cherished ideas of the alchemist, and of the medical men of the fifteenth and sixteenth centuries, who laboured, the one to extract from substances what they called the quintessence of them, and the other to apply what they supposed then to be such quintessences. From the imperfect state of science, chemistry included, at that time, they were unable to carry out what they conceived to be essential to arrive at a better and more enlightened treatment of disease. They perfectly felt that the extracts or infusions of the plants they had at their command had not a defined action in their treatment. All men of science know with what enthusiastic perseverance Paracelsus advocated the employment of quintessences; and, although in his enthusiastic mind he went so far as to pretend that he carried in the head of his cane the elixir of life, there is no doubt that he and his disciples left a germ, which has gradually grown to be a plant, and that the chemistry of the present day is gradually succeeding in extracting from plants their active principles. Although medical men were convinced of the utility of employing the active principles existing in plants, as quinine, cinchonine (from cinchona bark), morphine (from opium), &c., still we had not a correct idea of the various actions which these diverse alkaloids exerted on the system. We are, therefore, much indebted to M. Claude de Bernard for his admirable researches on the therapeutic action of the alkaloids of opium; and owing to his extensive physiological knowledge, as well as his perfect mode of carrying out his experiments, he has proved that we can class the action of the alkaloids of opium under three heads, as shown by the following table:—

The Alkaloids of Opium.

Soporific.	Convulsive.	Toxic.
Narceia.	Thebaia.	Thebaia.
Morphia.	Papaverine.	Codeia.
Codeia.	Narcotine.	Papaverine.
	Codeia.	Narceia.
Not Soporific.	Morphia.	Morphia.
Narcotine.	Narceia.	Narcotine.
Thebaia.		
Papaverine.		

These researches thoroughly prove the correctness of Paracelsus's views, showing that in the employment of opium due consideration should be given to the fact that in that opium there are various agents acting in a defined manner upon the organs of his the patient.

I cannot conclude this lecture without drawing your attention to several interesting papers which have been published by Dr. Polli, of Milan; Davanne, Rayer, and and Le Mare, of Paris, tending to prove that the source of many diseases, especially those a contagious nature, may be due to the sporules, or germs of certain animal or vegetable ferments which penetrate with the air into the system, coming in contact, as it does, with the blood in the lungs of man. The difference between the views of these gentlemen and those who preceded them is that formerly these statements were merely theoretical, whereas these gentlemen, by the aid of the powerful microscopic instruments now brought into use, have been able to trace the presence of vegetables or animals in blood either of animals or man affected with certain classes of disease. I may cite as an example the discovery in the blood of the carbuncle, of the presence of vitrios and bactherea. (Royer and Davanne.) These facts explain why these gentlemen have applied with such success the most powerful antiseptic agent yet known in the treatment of that disease, namely, carbolic acid, and there is no doubt in my mind that the spread of either scarlet fever, typhoid fever, cholera, or any diseases arising from the decay of blood or its decomposition is brought about by the introduction into the blood of certain ferments which completely alter the nature of that fluid, as in the case of the carbuncle and similar diseases. If these views are correct—and I think I

am justified in saying that they have the support at the present day of some of the most eminent men on the continent—the employment of carbolic acid, either to prevent the spread of, if not to cure these diseases, deserves the attention of the medical world.

PARIS UNIVERSAL EXHIBITION OF 1867.

The Minister of State, Vice-President of the Imperial Commission, has just issued the articles relative to the Scientific Commission referred to in the general scheme of the Commission.

Article 1.—An International Scientific Commission is established in connection with the Imperial Commission, and has for its objects:—

1. To point out the means by which the recent progress has been made in the sciences, the liberal and the ordinary arts.
2. To aid in the propagation of useful discoveries, and in inducing reforms in matters of international interest, such as the adoption of the same weights, measures, scientific units, &c.
3. To point out, by means of special publications, the results, of general utility, which may be derived from the Exhibition, and, if necessary, to take measures for their completion.

Art. 2.—The Scientific Commission to consist of natives of France, named by the Imperial Commission, and of foreigners nominated by various countries. These nominations will be duly announced from time to time.

Art. 3.—Scientific bodies, and, in general, those who interest themselves in the progress of the sciences and arts, are invited to submit to the Imperial Commission their advice on the means to be adopted and the questions to be examined.

Art. 4.—The members of the Scientific Commission will not be required to attend any periodical meeting. They may work out alone the subjects which they are charged to treat upon, and remit the result of their labours to the Imperial Commission in their own name. At the same time they may act in concert with their colleagues if they think fit.

Art. 5.—The memoirs and reports will be submitted to the Imperial Commission before the 1st of July, 1867, and published, if found advisable, by its authority. These memoirs and reports will together form the works of the Scientific Commission.

The preparatory works of the Exhibition have been commenced; a number of workmen are now engaged in forming the ground-work of the grand avenue, a hundred feet wide, which will traverse the entire space of the Champs de Mars, from the quai to the Ecole Militaire in the rear. The ground is also being prepared on the Quai de Javel for the railway which is to place the Exhibition in communication with the whole of the grand lines of France by means of the Chemin de Fer de Ceinture and the Auteuil line.

Amongst the various objects of interest which are mentioned as likely to be seen in that portion of the park around the building which is to be devoted to the French exhibitors, are:—Model farms of the various provinces, with their stables, cattle-sheds, dairies, steam and other agricultural machinery, and apparatus for making bricks, tiles, and drain-pipes; distilleries of spirits, essences, and resins; a charcoal manufactory complete, with a shop for the sale of its productions; a complete photographic establishment, and a dark chamber for photometric experiments; a manufactory of perfumes, and principally of extracts from certain flowers, such as the jasmine and tuberose, which will be cultivated, if possible, in the park itself; a horizontal flour-mill, and establishments for producing bread and pastry for the supply of the Exhibition; an electric lighthouse, two hundred feet high, for illuminating the park at night; and a coast light-house of the first order; an establishment for the cupellation of lead, and the making of copper and leaden pipes; an iron and bronze foundry; a glass-house; and manufactories of white-lead, sodium, and other chemical products.

A special site is said to be reserved for an observatory, where astronomical and philosophical instruments will be exhibited in action, and another for a campanile tower, with clock and chimes. Several hothouses and conservatories, exhibiting various methods of construction and heating, and filled with exotic plants; kiosques, chalets, rustic houses, fountains, ornamental vases, and garden furniture of all kinds will be distributed about the grounds. Architecture and construction will be illustrated by specimens of the principal modes of building in stone, brick, pottery, imitation marble, cement, concrete, and wood. One exhibitor proposes to contribute trees and shrubs, ranging from one to six metres high, sufficient to form fifty-three clumps, to fill a total space of seven hundred square metres.

Such are a few of the promised attractions of the Universal Exhibition of 1867.

FRENCH INDUSTRIAL COLLEGE.

The *Union Centrale des Beaux Arts* of Paris, whose admirable exhibition is now open in the Palais de l'Industrie, has just determined upon the establishment of a great college for pupils in the industrial arts. The directors of the Union consider that in order to give sound education in art as applied to industry, something more is wanting than museums, libraries, and courses of lectures, however excellent and complete in themselves, and the first step has been taken to unite all the means of instruction in one great collegiate establishment.

A piece of ground, containing between fifteen and sixteen thousand square yards, has been secured in the immediate neighbourhood of the Faubourg Saint Antoine, the very centre of the manufacturing quarter of Paris. The new college to be raised on this spot is to afford accommodation for five hundred resident pupils, and the organisation will include all that is necessary for the study of industrial art in its various branches; it will be a great normal school for the training of designers and managers of artistic establishments. The society itself will occupy one wing of the building with its museums and library, and it is proposed that each division of the former shall be decorated in the style of that epoch of art of which its contents will form the illustration, and that, as far as possible, the books, drawings, engravings, and other matters relative to the period shall be placed in immediate proximity with that section of the museum to which they have special reference. The estimate sets apart a sum equal to £12,000 for the annual salaries of the professors, in order that the most able industrial artists may be induced to lend their aid in the training of the rising generation of art-workmen. An important feature in the plan is the establishment within the college of a certain number of *ateliers d'honneur*, which will be given, for life or otherwise, to eminent artists and art-workmen, whose example will best guide the hand, instruct the eye, and cultivate the taste of the pupils. It is proposed, amongst other things, to include a school of equitation in the establishment of the college, not only with the view of supplying the pupils with the means of a healthful exercise, but also of making the eye acquainted with the living model of the animal in its various movements; and to arrange the lecture theatre in such a manner that it may be used for dramatic representations, the pupils being at once the scene painters, costumiers, and actors, and thus becoming theoretically and practically acquainted with an important branch of industrial art.

It is not intended that the education of the college shall be gratuitous; on the contrary, the fees will be rather high; but it is proposed that the sons of working

men shall be admitted to the courses of study, as out-of-door pupils, on payment of three francs a month.

Modifications will doubtless be made in the scheme as now sketched, but there is little doubt that the proposed college will be established, and the *Union Centrale* may well be proud of being the first body which has thought of applying the principle of thorough collegiate education to industrial art.

It is worthy of remark that the project is quite independent of the government; the first idea is said to have been thrown out by M. Duruy, the Minister of Public Instruction, who is indefatigable in improving the means of education of every kind, but the initiative is due to M. Guichard, the President of the *Union Centrale*, who not only drew out the scheme of the new college, but, in conjunction with M. Sajou, another member of the direction of the society, supplied the funds for securing the land on which the building is to be erected. M. Guichard is an architect and decorative artist, and M. Sajou a modeller of upholstery, so that the new college springs directly from the class to which it is to be devoted.

Manufactures.

BRADFORD CHAMBER OF COMMERCE.—RUSSIAN TARIFF.—A special meeting of the Chamber of Commerce was held recently, at Bradford, for the purpose of meeting Mr. Michele, *attaché* to the British Embassy at St. Petersburg, who attended with patterns of Russian goods, similar to woollen and worsted fabrics manufactured in this district, upon which he desired to elicit the opinions of the chamber. H. W. Ripley, Esq., the president of the chamber, occupied the chair, and the other gentlemen present, besides Mr. Michele, were Mr. Alderman Mitchell, Mr. J. A. Unna, Mr. C. Stead, Mr. Jacob Behrens, and Mr. H. C. Churton, Mr. Hirst, of Leeds, and Messrs. Grierly and Jubb, of Batley. The President briefly introduced Mr. Michele, and stated that he had accompanied Mr. Lloyd, President of the Associated Chambers, and Mr. Goodman in their visit to the Moscow Exhibition. Mr. Michele, in introducing his patterns of goods to the notice of the meeting, said his principal object was to obtain as minute a report as possible of these goods, in order that, in the report he should have to submit to Earl Russell, he might make a comparison of the relative cost of the production of the two countries—Russia and England—because there were many arguments in favour of the reduction of the high rate of duty in Russia which might be deduced from such an inquiry. They would probably find that up to a certain point Russia produced qualities of goods with which foreign countries could not compete. On the other hand, the higher qualities were produced far cheaper and much better here. This might be an argument in favour of reducing the duties on those low qualities. Mr. Lloyd and Mr. Goodman had done good service in this direction—they had sown good seed, which, no doubt, in due time would germinate and bring forth fruit. Very probably within the next few years a considerable reduction in the Russian tariff would be made. There was great opposition on the part of the manufacturers. The Russian government were not absolutely opposed to the principles of free trade, but they had to defer to the opinion of the people they governed. Public opinion in that country had great weight at the present time, and the Russian government were afraid of committing themselves to any policy which might be condemned by large sections of the people. Therefore, this question would have to be agitated, and he had no doubt, with the aid of the press and by other means, it would ultimately be made manifest to the people of Russia that they had nothing to fear from competition, but that, on the contrary, their manufactures would be improved and wider markets created. Mr. Michele cited some of the protectionist arguments which were at present used in Russia, and said that by the diffusion of more enlightened economical views upon this question the result in a few years would no doubt be the gradual reduction of the Russian tariff. Her Majesty's government were quite ready at any favourable opportunity to exert their influence with the Russian government to bring about such a change in our commercial relations with Russia as would be conducive to the mutual advantage of the two countries. The gentlemen present formed themselves into a committee to examine the patterns of goods and report thereon.

Commerce.

THE INDIAN TEA TRADE.—This trade (says Travers' Circular) is still in its infancy, and though its prospects are far more satisfactory than those of Japan, there are still many difficulties to be overcome before it can reach the development of which it is capable. Although India is an old dependency, it is but a young colony; in fact, it is still in transition from one state to the other. The aboriginal inhabitants and the European settlers are in an anomalous position, mutually jealous of each other, and for the most part without any common interest or sympathies; and it is no easy task for the Government officials, brought up among the traditions of the old *regime* to accommodate themselves to the new state of things, and to observe a strict neutrality between the disputants. There is great room for improvement, also, in the regulations framed for the sale of waste land, suitable for the cultivation of tea; the present system appears to lead to great abuses, and to retard rather than to advance the object for which it was framed. But India possesses what Japan does not—a stable and enlightened Government; old traditions are gradually dying out, as fresh legislators, with independent ideas, are brought in to fill up the gaps which so frequently occur even in the ranks of civilians serving in a tropical climate; education is spreading rapidly among the natives, and already a more intelligent class of colonists is being attracted by the prospect of obtaining, in a few years, at small risk of health, and with comparatively little labour, a competence which the work of half a life-time spent in Europe might fail to secure. The Indian tea plantations only require time to mature, and the skill of a sufficient number of intelligent Europeans, backed by a good supply of native workmen to perform the heavier manual labour, and the result is certain. The great experience in tea cultivation which the Chinese enjoy, aided by their industry and business ability—qualities for which the natives of India are not remarkable—will probably always make China the largest tea-producing country of the world; but their feeble government, and the unlimited exactions of their rulers, will be found to be serious drawbacks in a competition with a country living under British rule, and India, possessing this advantage, cannot long continue to be far behind in the race.

COTTON CULTIVATION IN INDIA.—It appears, by the *Cotton Supply Reporter*, that the report of the Cotton Commissioner of the Bombay Presidency upon the distribution of American seed, and the means taken to extend the cultivation of the New Orleans variety, recently published by the Bombay Government, tends to explode the opinion so long and tenaciously held by those entrusted with the management of Indian affairs, that cotton of a quality to rank with American cannot be grown *in* India. The repeated recommendations of the Cotton Supply Association to promote and encourage the growth of this description of cotton in that country have more than once been met with the reply that the experiment had been tried and had failed, and that, therefore, it was useless to repeat it. In these papers their own officer shows to the Government that not only has there been success in Dharwar, as Mr. Shaw, to whose zealous and persevering

exertions that success is mainly attributable, has long since demonstrated, but in other districts also where similar exertions have been made. In Mysore, the ryots of their own accord have taken up the cultivation of American seed. In the North-west Provinces and the Punjaub, the Commissioner fully believes that the introduction of the New Orleans cotton from acclimatised Dharwar seed will be successful, and he is satisfied that the failure in Berar is only temporary, and is owing to the deterioration which the seed had undergone from having been shut up in the heated and close atmosphere of the ship's hold, and to lateness in sowing. "It is held to have been demonstrated in this Berar experiment that cotton of staple and colour which will always hold its place in the British market may be grown to a good profit by Indian ryots in Central India." The conclusion adopted is, that not only will the acclimatised American plant thrive in many districts of the Punjaub and North-west Provinces and elsewhere in India, but there is good ground to expect that "the home market will be extensively supplied" from those sources with this description of cotton. Our hope of India, though long deferred, is thus, it seems, to be realised at last. This much may at least be expected, that the representations and counsels so often urged upon those at the head of Indian affairs will now, thus corroborated, obtain a degree of attention which hitherto they have failed to command.

Colonies.

Sugar Cultivation in Queensland.—It seems now clearly proved that this class of cultivation has taken firm root in this colony, many thousand acres having been taken up for sugar-growing purposes, under the new regulations which grant a lease of any unoccupied Government land selected, at a very low figure, to actual cultivators, with a purchasing clause during any renewal or expiry of the lease, leaving the capital of the sugar-grower intact to further his business, and at the same time securing him the land as if he were a freeholder. There are tens of thousands of acres still available for sugar-growing.

Cotton in Queensland.—A considerable number of the cotton cultivators of this colony lately held a meeting to urge on the Government the necessity of continuing the cotton bonus regulations for a few years longer, and which there is every reason to expect will be done. The last season has fully proved the adaptability of the colony for growing cotton, the crop having proved a profitable one.

An Expedition has just started for the interior of the Australian continent. This time the object is not so much to obtain an acquaintance with the country—although that of course will be one of the results—as to solve the mystery of the life or death of Dr. Ludwig Leichardt, who, in 1848, started from the settled district of Queensland to endeavour to cross the continent to the Gulf of Carpentaria, and who has never yet been heard of. The mystery connected with his fate, commencing at this date, still remains to be cleared up after the elapse of 17 years. A subscription has been raised by the ladies' committee to the amount of £900. The Victorian and South Australian governments have contributed each £500; the Queensland government has given £1,000; the Sydney government intends to double private subscriptions. The party engaged to conduct the search consist of eleven persons, all accustomed to bush life, and mostly of middle age. None of them, however, except the leader and a surgeon, have been to previous explorations. They are accompanied by 14 camels and over 40 horses.

Intercolonial Exhibition at Melbourne.—The Legislative Assembly having assumed the desirability of intercolonial exhibitions of industry and art, steps will be taken to hold the first intercolonial exhibition in Melbourne during the ensuing year. A grant of £2,000 has been sanctioned by the colonial parliament; and, in order that ample time may be afforded to mechanics, artizans, and manufacturers to enter into competition, a royal commission will be appointed, and the conditions of the exhibition promulgated. The liberality of the Victorian government ought to receive such encouragement as will induce the colonies generally to participate in the advantages of the show, and remove those jealousies which, at the outset, are likely to operate against the scheme.

Obituary.

Thomas Winkworth.—Another of the few remaining links between the past and present in the history of the Society of Arts has been severed. Death has recently removed from the Council table one of the oldest and most tried friends of the Society. In 1822, Thomas Winkworth was elected a member of the Society of Arts, and from that time he never ceased to take an active interest in its work. Born in 1790, the son of the Rev. William Winkworth, at the age of sixteen he was apprenticed to a silk manufacturer in Spitalfields, and thus became intimately connected with the commercial interests of his country. After serving the usual period of apprenticeship, and being made a freeman of the Fishmongers' Company, he established himself as a manufacturer and merchant in the City of London in 1819. He purchased the freedom of the Weavers' Company, and soon became known and active among those who, some forty years back, took steps to free the silk trade from the restrictions under which it was at that time carried on. He also gave great attention to all that was being done about the same period to improve the mechanical appliances of the weaver. Having joined the Society of Arts, he soon evinced a lively interest in its proceedings—an interest which was ever increasing and progressing. From his first entrance into life as a manufacturer he desired to be free from all the antiquated forms and practices which restricted industry, qelieving that, as in fashion, so in the modes of carrying on industries, the public demand a constant change, not so much in the materials employed as in the method and form of applying them. This conviction led him to give much time and attention to the Society of Arts, and in any and every effort to render that body more vigorous, his active co-operation was always to be relied on. He was one of those who helped to remove the restriction which prevented the Society from rewarding inventions when patented, a restriction which was in force up to 1844. In 1846 he advocated with other members the incorporation of the Society by Royal Charter. He very early recognised the importance of giving to Industrial Exhibitions an international character, and never ceased to take an active interest in them. He acted as Juror, and reported on the International Exhibitions of 1851, 1855, and 1862, as well as those of Dublin in 1854, and Florence in 1860. Since 1862 he allied himself to the movement which has spread so rapidly among the working classes and created so many displays of their industry; at the time of his death he was both a trustee and guarantor of the North-East London Exhibition—now open. He was a warm advocate of all those measures which tended to improve the educational, social, and moral condition of the industrial classes. The members of the Society well know how constant an attendant and zealous a worker he was at the Society's meetings, and the *Journal* contains many evidences of his zeal and good wishes for the prosperity of the Society of Arts. He died on the 15th September, after a few hours' illness, at his residence in Canonbury, aged 75, and was interred at Highgate Cemetery, deeply regretted as an affectionate father, a sincere friend, and a useful and upright citizen.

JOSEPH F. B. CHARRIERE, one of the most celebrated surgical instrument makers in Europe, died recently. Science and humanity generally owe him a deep debt of gratitude for the immense improvements which he has made and induced in the art to which he devoted himself. M. Charrière was born at Fribourg, in Switzerland, in 1803, but he was apprenticed to a cutler in Paris; he was the founder of the establishment which he conducted to the day of his death. His instruments have earned him medals and recompenses at numberless exhibitions; he was made Chevalier of the Legion of Honour in 1844, and after the Great Exhibition of 1851 was raised to the grade of officer of the order.

Publications Issued.

LES OUVRIERS D'A PRESENT ET LA NOUVELLE ECONOMIE DU TRAVAIL. By M. Audiganne. (Paris. 8vo.)—An attempt, by an able writer, to indicate the various phases of the life of the working classes, and to show what influences are at work which may produce changes in the economy of labour. The labourer himself, the tools and machinery employed, and the principles of association, are naturally three main heads of the discourse. The author belongs to the liberal school of the economy of labour, but he does not commit himself to the announcement of any special theory for the future.

CODE INTERNATIONAL DE LA PROPRIETE INDUSTRIELLE, ARTISTIQUE, ET LITTERAIRE. By J. Pataille and A. Huguet. (Paris. 8vo.)—A collection of the conventions and regulations of European governments respecting patents, literary productions, the theatre, music, the fine arts, trade marks, and piracy, with an explanatory introduction.

ANNALES DE LA PROPRIETE INDUSTRIELLE, ARTISTIQUE, ET LITTERAIRE. By J. Pataille and other writers. (Paris. 8vo.)—The eleventh number of an annual publication, containing a large amount of important facts and opinions relative to artistic, literary, and industrial questions.

Notes.

TAPESTRIES AT HAMPTON COURT PALACE.—The removal of the miscellaneous portraits from one of the long galleries of this palace to the Cartoon Gallery has disclosed a fine series of decorative tapestries on the walls, which are of the latter part of the seventeenth century, and are well fitted to the room. It is to be hoped that Mr. Cowper will allow them to remain, being part of the original decorations of the building, and much more appropriate and decorous than a number of miscellaneous portraits hung without any classification.

CHEMICAL SCIENCE IN GERMANY.—Such is the appreciation of chemical science in Germany, that at the present time two large chemical laboratories, on the most complete scale, are in course of being erected in Berlin and Bonn, at the expense of the state. They will cost, it is said, about £75,000.

COMPOUND BRIDGE.—A new bridge, constructed over the Seine, between St. Cloud and Sèvres, has recently been opened for foot-passengers and vehicles. It is a compound bridge, for general traffic and also for the continuance of the Auteuil railway, which by its means will be carried almost to the gate of the Exhibition of 1867, and also placed in connection with the Chemin de Fer de Ceinture, which connects all the main lines of railway having termini in Paris. The bridge is a handsome, though simple structure, of five arches, about 360 or 370 feet long, and perfectly level, the banks being high at the spot where it crosses the Seine. The total width of the bridge is full 90 feet, and affords room for the railway viaduct, two carriage-roads, each twenty feet wide, and two broad footpaths. The viaduct occupies the centre of the bridge; it is about forty feet high above the carriage-ways on each side of it, and the walls of the arches of which it is composed, as well as of the viaduct beyond the bridge on either side of the river, are pierced throughout by two smaller arches, which will afford a double covered way for foot passengers for the distance of about a mile. The whole is built of stone, carefully dressed and finished, and presents a very elegant appearance.

POSTAGE STAMPS.—A proposal has been made to the Minister of Finance, by French merchants, for the issue of postage-stamps of the value of five, ten, and twenty francs each, to be used not only for the prepayment of heavy packets sent by post, but also for the discharge of small accounts. The existence of some such means of payment between England and France would be a great boon, and now that a system of post-office orders exists between France and Italy, there is some natural impatience on the subject. For the payment of sums too small for cheques no ready means exists, although the rapid growth of relations between England and France so much demands such an arrangement. It has been asserted that the idea of a stamp for prepayment of postage originated in France in the reign of Louis XIV., but in the absence of any proof of the fact, little attention was paid to the assertion. The following notice, said to have been issued in the month of August, 1653, has appeared in a French newspaper:—"On fait sçavoir, y est-il dit, à tous ceux qui voudront escrire d'un quartier de Paris en un autre, que leurs lettres, billets ou mémoires seront fidellement portés et dilligemment rendus à leur adresse, et qu'ils en auront promptement réponse, pourvu que, lorsqu'ils écriront, its mettent avec leurs lettres, un billet qui portera port payé, parce que l'on ne prendra point d'argent, lequel billet sera attaché à ladite lettre ou mis autour de la lettre ou passé dans la lettre, ou en telle autre manière qu'ils trouveront à propos, de telle sorte néanmoins que le commis le puisse voir et oster aysément. Chacun estant adverty que nulle lettre ni réponse ne sera portée, qu'il n'y aye avec icelle, un billet de port payé, dont la date sera remplie du jour et du mois qu'il sera envoyé, à quoy il ne faudra manquer, si l'on veut que la lettre soit portée. Le commis général qui sera au palais, vendra de ces billets de port payé à ceux qui en voudront avoir, pour le prix d'un sol marqué, et non plus, à peine de concussion; et chacun est adverty d'en acheter pour sa nécessité, le nombre qu'il lui plaira, afin que lorsqu'on voudra escrire, l'on ne manqne pas pour si peu de chose à faire ses affaires," with the following memorandum appended:—"Outre le billet de port payé, que l'on mettra sur cette lettre pour la faire partir, celuy qui escrira aura soing, s'il veut avoir réponse, d'envoyer un autre billet de port payé, enfermé dans sa lettre." The stamp, or rather ticket, as may be seen, from the above quotations, applied only to Paris, cost one "sol," or halfpenny, had to be purchased beforehand at the palace, might be fixed on or placed in the letter in any way, provided the clerks could see it, but required to have the day of the month when it was used marked upon it. Moreover, its use was rendered obligatory by the announcement in question. It was doubted whether this order had ever been carried into practice, but a letter addressed by M. Pelisson to Mdlle. de Scuderi, to which such a ticket had been attached, is said to be in the possession of M. Feuillet de Conches. At any rate it is clear that the system was soon abandoned, and that no method of payment by means of stamps or tickets was in use in France until the year 1849. In the following year the issue of stamps amounted to 21,523,175; in 1864 it was 382,655,450. The value of the annual augmentation since 1854 has varied between three and four millions of francs.

VINTAGE IN THE NEIGHBOURHOOD OF PARIS.—The vintage began in some parts of France as early as the middle of August, and nearly everywhere in the first week in the present month. It is not perhaps generally known that from seventy to eighty thousand casks of wine are produced annually in the district to the north of Paris, and of which Argenteuil is the centre. There

are about fifteen hundred vine growers in the locality in question. The vintage commenced on the 7th September, about nine thousand persons being engaged to aid in the gathering. The opening of the vintage is officially announced, and labourers, male and female, come from all parts to the little town of Argenteuil, where they camp in the streets for the night, roasting potatoes for their supper by bonfires, and singing and dancing till three in the morning, when the vine growers appear, engage as many hands as they require, and march off home, each at the head of their squad. The scene is one of the most extraordinary that can be witnessed when the narrow streets of Argenteuil are filled with ten thousand men, women, and youths, all determined to enjoy their annual *fête*. The great abundance of grapes, and the heat of the weather made the scene this year more noisy and more exciting than usual. It is calculated that the yield will reach nearly a hundred thousand pieces, or about six millions of gallons. In old times, when the crop was good, a cask was often filled for fifteen or twenty francs, say about three pence per gallon, but in 1855 the price had risen to considerably over a hundred francs. A hundred years ago the wine of Argenteuil was considered equal if not superior to Burgundy or Champagne; if that appreciation was a just one, the metropolitan grapes must have sadly deteriorated, or the products of the latter provinces greatly improved, unless indeed a great change has come over men's palates, for certainly at the present moment no one will drink the wine of Argenteuil if he can obtain any other.

ECONOMIC RAILWAYS.—In the *Journal* of the 7th of July last will be found an account of the measures adopted by the French Government for the extension of the railway system to the rural districts of the country, and of the economical arrangements connected with the plan. The realisation of the object in view depends, in some measure, on the adoption of light and efficient engines, and the government has recently purchased the free use of a locomotive designed by an engineer named Rarchaert, for the purpose of running on light rails, and passing over sharp curves and steep inclines. M. Rarchaert's engine, with tender and fuel, does not exceed twenty tons in weight, has four pairs of wheels, coupled, and will not require rails exceeding forty pounds in weight to the mètre. The pressure of each wheel would thus be equal to two tons and a half, while that of the locomotives in use on the great lines ranges between five and six and a half tons, and the rails themselves weigh from seventy to eighty pounds per mètre. The engine is said to be able to draw 640 tons, in addition to its own weight, on a level, 310 tons up an ascent of 5 in 1,000, and so on, to 74 tons on a gradient of 30 in 1,000; and, at a speed of from eighteen to twenty-four miles an hour, it will, according to the inventor, work safely on curves of a minimum radius of sixty mètres; and, therefore, by adopting gradients varying from 12 to 30 in 1,000, nearly all necessity for tunnels, viaducts, and embankments would be avoided. The inventor calculates that under his system the average cost of these local railways will not exceed 60,000 francs the kilomètre, or less than £4,000 per English mile.

Patents.

From Commissioners of Patents Journal, September 29th.

GRANTS OF PROVISIONAL PROTECTION.

Breech-loading fire-arms and cartridges—2345—F. W. Prince.
Cages and hoists, safety apparatus for—2383—J. C. Broadbent.
Cast-steel—2277—J. Grand.
Cotton wool, &c., combing—2164—G. Little.
Crucibles—1884—G. Nimmo.
Dry docks, floating—2387—E. Clark.
Effervescing drinks—2377—O. W. Jeyes.
Electro-magnetism as a break power on railways—2238—E. Cowper and D. Hancock.
Fire-arms—2275—J. Snider.
Flying toys—2208—H. A. Bonneville.
Gases made in smelting iron, separating dust from—2391—E. A. Cowper and C. W. Siemens.
Gun barrels, tubes for—2351—G. P. Harding.
Harrows, &c.—2331—J. Badger and J. H. Steff.
Hides, &c., splitting, shaving, and paring—2282—H. H. Doty.
Hydraulic break—2337—W. J. Murphy.
Hydro-carbon or paraffin oils, treatment of—2008—J. W. Perkins.
Hydropults and hydrostatic pumps—2305—J. Webster.
Iron—2347—W. Unwin.
Knitting cotton, winding—2311—H. Shanks.
Locomotive engines—2329—R. Aitken.
Metal articles, shaping—2371—J. H. Johnson.
Metals, casting—2401—D. Spink.
Mills for grinding—2264—W. Barford and T. Perkins.
Motive power, obtaining—1832—H. A. Dufrené.
Night lights—2367—F. Meyer and J. W. Freestone.
Perambulators, &c., canopies for—2389—H. Lloyd.
Pipes used for smoking—2325—C. A. McEvoy.
Projectiles—2281—A. V. Newton.
Pulleys—2333—G. Tangye and J. Jewsbury.
Railway breaks—2375—H. Henry.
Railways, signalling on—2309—J. Anderson.
Raisins, apparatus for stoning—2301—J. Askew.
Revolvers, breech-loading—2210—P. Polain.
Rivets—2355—J. Wakefield.
Save-alls—2369—H. A. Bonneville.
Ships and other vessels, propellers for—1645—C. Hook and A. Peace.
Shirts—2254—J. M. Carter.
Skates—2180—J. I. Barber.
Spinning frames—2343—A. V. Newton.
Steam boilers, preventing incrustation in—2272—J. Howard, W. Stafford, and W. P. McCallum.
Steam boilers, safety valve for—2323—H. Hackett, T. Wrigley, and E. Pearson.
Stone, cutting—2363—A. V. Newton.
Submarine telegraph cables—2341—J. O. C. Phillips.
Telegraph cables, submerging—2261—J. Sproul.
Telegraph cables, apparatus for laying—2262—K. J. Perceval.
Tobacco, cutting—2359—E. T. Read.
Type for printing, apparatus for "composing" or setting—2303—A. Mackie and J. P. Jones.
Vent pegs—2365—R. M. Lowne.
Watches, &c., winding-up—2274—R. A. Brooman.
Wearing apparel—2317—R. C. Newberry.
Weaving, looms for—2295—J. Smith.
Wheat, &c., mills for grinding—2399—J. Tye.
Windows, opening and closing—2319—J. Pennington.
Wool, &c., combing—2299—A. Morel.
Yarn cops, winding—2297—W. Oldham.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Electric bells, &c., ringing—2421—W. Moseley.
Machinery, lubricating—2429—H. A. Bonneville.
Peat or turf for fuel, preparing—2436—T. V. Lee.

PATENTS SEALED.

722. N. N. Solly.	962. J. G. N. Alleyne.
906. J. and D. Swarbrick, B. and O. Swarbrick.	963. H. Simon.
907. L. Bridge.	971. F. R. Ensor.
908. J. Poole and T. Brown.	972. C. Esplin.
922. H. Lewis.	986. P. Hugon.
923. R. A. Brooman.	991. S. Smith and J.W.Jackson.
924. G. Burt.	1029. J. H. Johnson.
926. J. Kennan.	1038. J. Haworth.
928. A. W. Pearce.	1049. J. S. Bickford.
940. F. Brown.	1086. J. E. H. Andrew.
945. J. R. Wigham.	1108. J. Y. Betts.
948. A. and H. Illingworth.	1151. G. Davies.
949. W. Brookes.	1834. N. Jenkins.
950. C. Martin.	1909. W. S. Yates & A. Freeman.
951. R. Baynes.	1941. A. V. Newton.
954. W. Moody & W. J. Huband.	1958. W. E. Newton.

From Commissioners of Patents Journal, October 3rd.

PATENTS SEALED.

966. W. Teall, L. Lepaige, and E. T. Simpson.	1002. W. E. Gedge.
967. J. I. Darribet.	1007. G. Davies.
969. C. W. Lancaster.	1009. V. A. Prout.
970. E. Ritherdon.	1030. J. H. Johnson.
976. E. H. Newby.	1041. F. P. Warren.
987. A. Muir.	1055. A. Westhead.
989. E. Welch.	1120. H. E. Newton.
994. J. Brown.	1264. W. E. Newton.
995. H. Edmonds.	1881. H. E. Gilles.
	1923. M. B. Schumann.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2633. H. Hutchinson.	2646. J. Bucknall.
2645. H. Ellis.	2653. J. L. Hughes.
2677. T. Greenwood.	2729. J. B. Palser.
2824. J. B. Payne.	2736. H. A. Marinoni.
2950. F. E. Sickels.	

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2195. H. Monier.	2306. G. T. Bousfield.
2183. J. J. Russell.	